

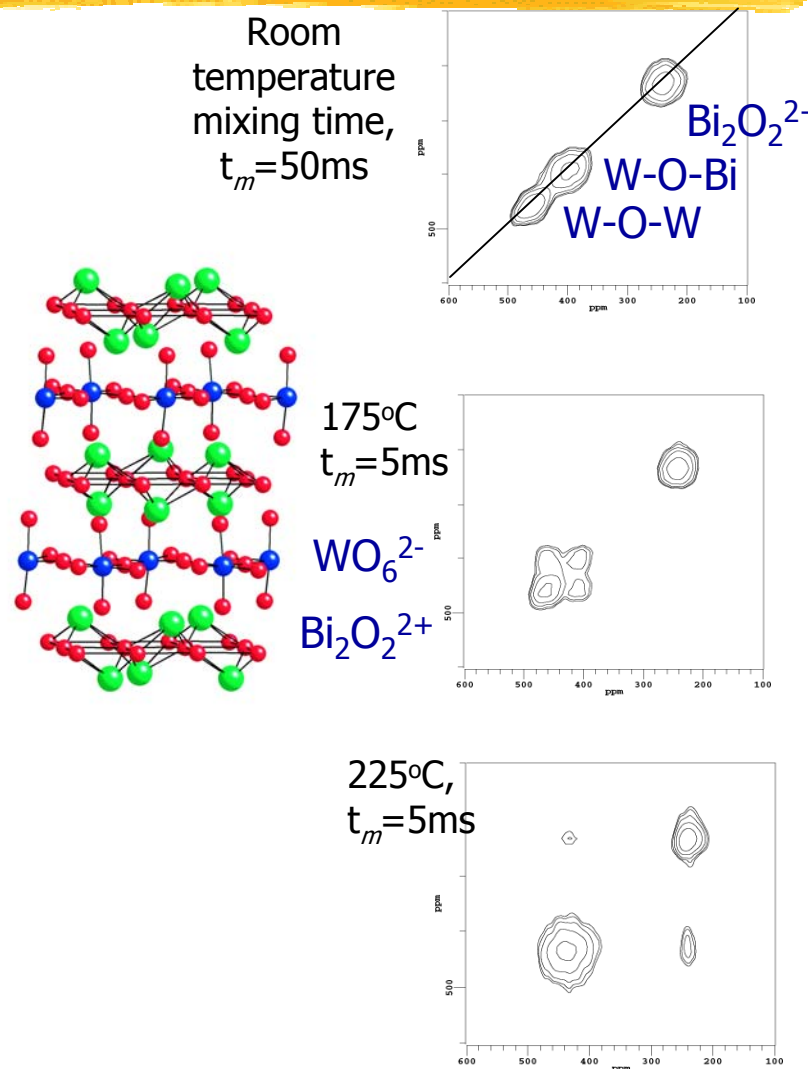
Two highlights of NSF (DMR)-supported research for 2002-2003: Clare P. Grey, SUNY Stony Brook

⌘ Anionic Conductors:

We have obtained the 1st two dimensional, exchange NMR spectra of anionic conductor in solids. This allows our approach (published last year in Science) to be extended to a much wider range of anion conductors with only moderately high conductivity. The figures on the right show exchange between the perovskite layers of Nb^{5+} -doped Bi_2WO_6 at 175 °C, and the much slower hops between oxygen ions in the $\text{Bi}_2\text{O}_2^{2+}$ and perovskite layers that starts at 225 °C.

⌘ Batteries:

Primary, alkaline and lithium ion batteries contain the highly disordered electrolytic manganese oxide (EMD) as the cathode material. We have provided the 1st clear cut experimental evidence (along with collaborators at Duracell) that the 1.4V process in alkaline batteries is due to intercalation in the tunnels of the EMD structure (near defects) and is not solely associated with a surface process, as previously thought. This result has important implications, because this is the so-called "high power process". Optimization of this process could lead to the development of improved batteries for applications that require high power, such as digital cameras.



Examples of the Broader Aspects of the Research Program

⌘ Industrial Connections:

Primary Batteries: This work involves a collaboration with W. Bowden and his colleagues at Duracell.

⌘ International Activities

(i) Lille University, France: Commenced a collaboration with Dr. Rose-Noelle Vannier to investigate BIMEVOXs and related compounds. A.c. conductivity studies are performed in Lille.

(ii) Oxford University, UK: Performed molecular dynamics simulations with Prof. Paul Madden, to test conductivity mechanisms, proposed based on our earlier ^{19}F NMR studies of fluorides

(iii) Tallinn, Estonia: Cooperated (and visited) the National Institute of Chemical Physics and Biophysics in Tallinn (Host: Dr. Ago Samoson), on the development of a high temperature magic angle spinning probe for use in our studies of oxygen-ion conductors.

(iv) Takamatsu and Tokyo, Japan: Initiated studies to investigate structures of manganese oxides with two groups in Japan.

⌘ Educational Activities:

Local Outreach: Presented talk in a SUNY Stony Brook outreach evening lecture series "The world of physics" entitled "Understanding how lithium-ion batteries and fuel cells work". Hosted two groups of high-school students in my laboratory.

University wide:

⌘ Member of the advisory group for Women in Science and Engineering program for undergraduates (responsible for the personnel and liaison with upper-administration). Presented a similar talk to the WISE students on my battery and fuel cell research.

⌘ Gave 3-day, hands-on, solid state NMR course (with B. Phillips), to graduate students and post-docs in Chemistry, Geosciences and Materials Science.